

## Case Report

# Combination of blunt cardiac and pericardial injury presenting a massive hemothorax without hemopericardium

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**Case:** A 64-year-old man was injured after falling from a height of 5 m and was transported to our institution. On presentation, his hemodynamic state was unstable, and both focused assessment with sonography for trauma and enhanced computed tomography imaging revealed massive left pleural effusion, but no pericardial effusion. He went into cardiopulmonary arrest just before surgery, so an urgent left anterolateral thoracotomy followed by open chest cardiac massage and aortic clamping were carried out. By performing an additional right anterior thoracotomy, a left pleuropericardial laceration and a perforation measuring 1 cm in diameter at the left ventricle were found. The patient's dynamic state stabilized following the restoration of hemostasis by suturing the rupture site.

**Outcome:** The patient's postoperative course was favorable, and he was discharged after 20 days of hospitalization.

**Conclusion:** Blunt cardiac and pericardial injury rarely causes massive hemothorax with no hemopericardium, resulting in hemorrhagic shock.

**Key words:** Blunt cardiac injury, cardiac tamponade, clamshell thoracotomy, hemothorax, pericardial injury

## BACKGROUND

BLUNT CARDIAC RUPTURE (BCR) is a rare, but lethal, thoracic trauma resulting in death in a short time with a high mortality rate of over 70%.<sup>1–3</sup> Moreover, when pericardial injury is complicated with BCR, the mortality rate is reported to be significantly higher.<sup>4</sup> The combination of cardiac and pericardial injuries frequently causes massive hemothorax, resulting in hemorrhagic shock or cardiopulmonary arrest (CPA) before arrival at the hospital. Even if the patient arrives with vital signs, the diagnosis of the two complicated injuries is challenging, because the hemopericardium may be decompressed into the thoracic cavity throughout the site of pericardial injury, which could prevent the development of cardiac tamponade and lead to a false-negative pericardial focused assessment with sonography for trauma (FAST).<sup>5,6</sup> We encountered a very rare case of blunt left ventricle rupture with pericardial injury that was successfully treated with emergency bilateral thoracotomy.

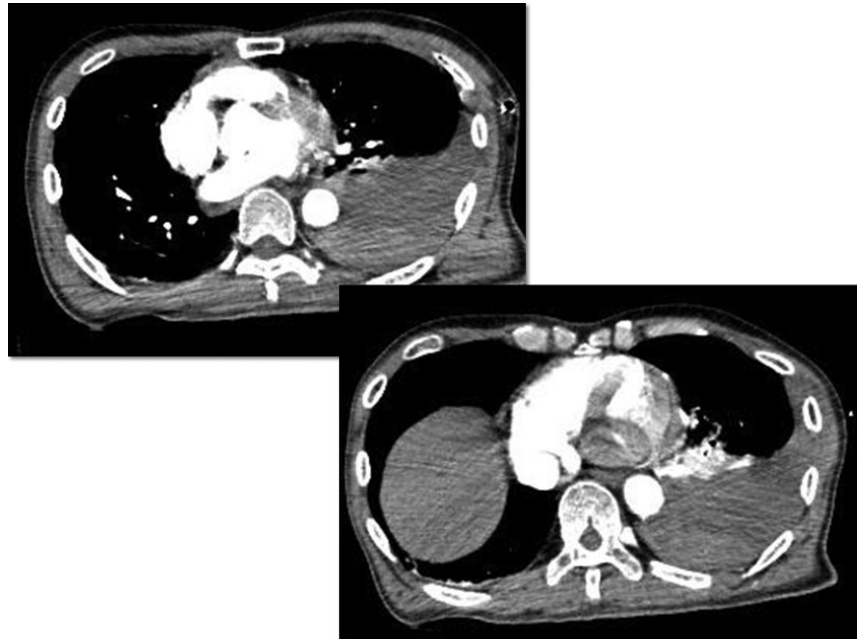
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## CASE

A 64-YEAR-OLD MAN FELL from a height of 5 m while driving a cart for weeding and sustained a crush injury to his chest from the cart. He was subsequently transported to our institution complaining of chest pain and arrived 36 min after the injury. His hemodynamic state was unstable, with a systolic blood pressure of 70 mmHg, a heart rate of 115 b.p.m. and a frequent respiratory rate over 30 breaths/min. The FAST revealed left pleural effusion without pericardial effusion, and a physical examination detected a flail chest combined with s.c. emphysema at the left thorax. Therefore, a chest tube was inserted rapidly, from which massive air leakage and 1000 mL of bloody output was seen. Tracheal intubation, fluid resuscitation including blood transfusion, and the insertion of an intra-aortic balloon occlusion catheter from the right femoral artery using a 9-Fr. catheter were subsequently carried out.

The systolic blood pressure had been elevated up to 110 mmHg, so an enhanced computed tomography (CT) scan was carried out, which revealed a left massive hemothorax with extravasation of contrast medium, although the origin was unclear (Fig. 1). The patient was transferred to the operating room for hemostasis due to suspected bleeding from the thoracic cavity 60 min after arrival at the hospital, but his hemodynamic state had suddenly worsened, and he went into



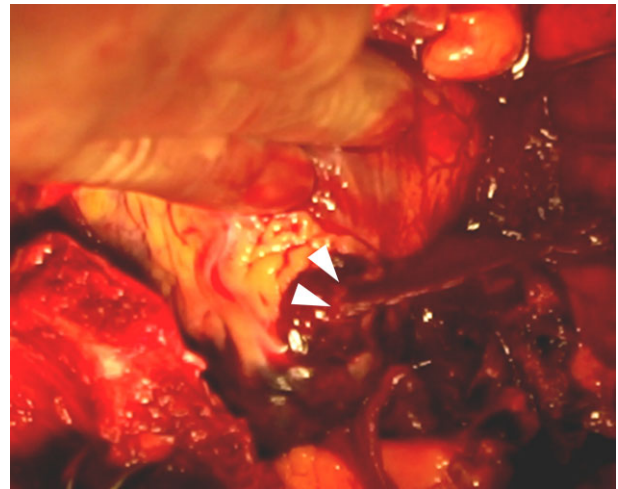
**Fig. 1.** Enhanced computed tomography scan of a 64-year-old man who fell from a height of 5 m and sustained a crush injury to his chest. The scan shows massive effusion of the left thoracic cavity, but no pericardial effusion.

CPA just before the operation was started. Urgent left anterolateral thoracotomy, followed by open chest massage and aortic clamping with i.v. administration of epinephrine was carried out, and consequently, a return of spontaneous circulation was acquired 3 min after the onset of CPA. The intraoperative findings revealed a left pleuropericardial laceration and bleeding from the pericardial cavity into the left thoracic cavity, although the bleeding site could not be recognized in the view.

By performing an additional right anterior thoracotomy, a “clamshell thoracotomy”, a perforation measuring 1 cm in diameter at the left ventricle was found, and consequently, hemostasis was achieved by suturing the perforation using 3-0 polypropylene monofilaments with pledgets, which stabilized his hemodynamic state (Figs. 2, 3). His postoperative course was good, and he was discharged after 20 days of hospitalization. His injury severity score, revised trauma score, and prognostic probability rate of survival were 41, 4.211, and 0.6%, respectively.

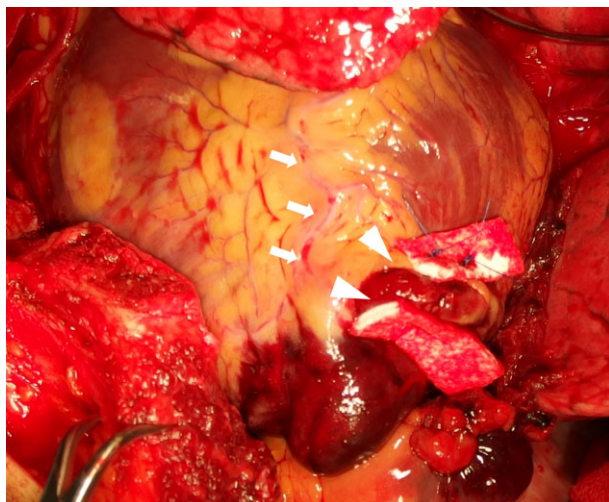
## DISCUSSION

**P**ERICARDIAL INJURIES ARE very rare, reportedly occurring in fewer than 0.1% of trauma patients; more than 50% of those were seen in the left pleuropericardial space, followed by the diaphragmatic and right pleuropericardial spaces.<sup>4,7</sup> Associated cardiac injuries were seen in 17–41% of patients with pericardial injury who presented with vital signs on admission.<sup>1,2,4</sup> In the present case, the



**Fig. 2.** A 64-year-old man fell from a height of 5 m and sustained a crush injury to his chest. A perforation of the left ventricle measuring 1 cm in diameter with a laceration of the left pleuropericardium was detected by clamshell thoracotomy. White arrowheads show the injured site in the left ventricle.

intrathoracic pressure increased suddenly due to the crushing pressure on the patient’s chest caused by the cart. Moreover, the very strong direct crushing force from the cart and the deformity of the ribs induced by the external force resulted in the patient’s injuries. The combination of these factors induced both the cardiac and pericardial damage.



**Fig. 3.** A 64-year-old man fell from a height of 5 m and sustained a crush injury to his chest. The perforated site of the left ventricle was sutured using 3-0 polypropylene monofilament with pledgets. White arrowheads show the site sutured with pledgets in the left ventricle; white arrows show the left anterior descending artery.

Isolated cardiac injuries often cause cardiac tamponade, while the combination of cardiac and pericardial injuries may not lead to tamponade. However, bleeding from the injured sites of the heart would jet into the thoracic cavity, resulting in death in a short time due to massive hemothorax. Therefore, patients with the two injuries typically do not show clinical signs such as the jugular venous dilatation or muffled heart sounds frequently seen in patients with cardiac tamponade, and consequently, the preoperative diagnosis of the two injuries remains a challenge.

For the patients with only penetrating cardiac injuries, FAST has been considered to be a useful and non-invasive diagnostic modality that can be performed in a short time with nearly 100% sensitivity and specificity.<sup>8</sup> Enhanced CT scanning, although restricted to a few cases in which the patients' vital signs are stable, was also reported to be useful for diagnosing BCR, with highly attenuated pericardial fluid collection, distension of the inferior vena cava, and periportal low-attenuation fluid signs that should lead to a suspicion of cardiac tamponade by BCR.<sup>9</sup> In the present case, both FAST and CT scanning revealed massive pleural effusion with no pericardial fluid collection, therefore BCR was not diagnosed preoperatively. The potential for a false-negative FAST result was considered, because BCR with pericardial injury can lead to decompression into the thoracic cavity, resulting in no hemopericardium. However, there have been few cases with these two complicated injuries in which no pericardial effusion was detected by a CT scan.<sup>5,6,10</sup> Consequently, the present

case, in which no pericardial fluid was detected by either FAST or CT, although a massive hemothorax was seen, is considered to be a very rare case with blunt cardiac and pericardial injuries.

## CONCLUSION

THE COMBINATION OF cardiac and pericardial injury is a very rare but lethal injury, and the diagnosis is challenging, even using FAST and CT scanning, because no pericardial effusion may be detected. Decision making, including the use of emergency thoracotomy with a clamshell thoracotomy, is imperative for prompt hemostasis and patient survival.

## CONFLICT OF INTEREST

NONE.

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